SOLUTION FOR SEALING POROUS METAL SUBSTRATES AND PROCESS OF APPLYING THE SOLUTION

Claims

The invention is hereby claimed as follows:

1. An aqueous solution for sealing the porosity of sintered, compacted powdered metal and liquid cast metal products from the group of metals, such as iron, steel, aluminum, titanium, magnesium, copper, brass, bronze, zinc, nickel, and their alloys, comprising a blend of:

5 to 50 parts 2:00 weight ratio aqueous sodium silicate solution,

5 to 50 parts 3:22 weight ratio aqueous sodium silicate solution, and

20 to 90 parts 2:50 weight ratio potassium silicate solution,

and diluted by filtered and deionized water in the range of 10 and 200% of the neat silicate blend.

2. The aqueous solution of Claim 1, wherein the silicate solutions are blended by low shear mixing.

3. The aqueous solution of Claim 1, wherein the neat silicate blend is modified by wetting agents, rheological agents, dyes, plasticizers, functional pigments, or lubricants.

4. The aqueous solution of Claim 1, wherein the blend further includes 0.0005 to 0.05 parts by weight wetting agent of the neat silicate solution weight.

5. An aqueous solution for sealing the porosity of sintered, compacted powdered metal and liquid cast metal products from the group of metals such as iron, steel, aluminum, titanium, magnesium, copper, brass, bronze, zinc, nickel, and their alloys, comprising:

36 parts 2:00 weight ratio aqueous sodium silicate solution,

24 parts 3:22 weight ratio aqueous sodium silicate solution, and

40 parts 3:22 weight ratio aqueous sodium silicate solution.

6. The aqueous solution of Claim 5, which is further diluted with filtered and deionized water, and modified by wetting agents, rheological agents, dyes, plasticizers, functional pigments, or lubricants.

7. The aqueous solution of Claim 5, wherein the silicate solutions are blended by low shear mixing.

8. A blended aqueous solution for sealing the porosity of sintered, compacted powdered metal and liquid cast metal products from the group of metals, such as iron, steel, aluminum, titanium, magnesium, copper, brass, bronze, zinc, nickel, and their alloys, comprising a blend of:

5 to 50 parts 2:00 weight ratio aqueous sodium silicate solution,

5 to 50 parts 3:22 weight ratio aqueous sodium silicate solution, and

20 to 90 parts 2:50 weight ratio potassium silicate solution, and

filtered water in the range of 10 and 250% of the neat solution weight of the blend.

9. The blended aqueous solution as defined by Claim 8, which further comprises:

a lithium silicate sol having a weight ratio of silicate to alkali expressed as SiO_2:Li_2 of typically 10:0.

10. A method of reducing the porosity of sintered powdered metal or cast liquid metal parts which comprises the steps of:

cleaning the metal parts, and sequentially

applying a solution of aqueous inorganic silicates to the surfaces of the parts,

allowing absorption of the solution into the parts,

removal of excess solution,

exposing the parts to air, and

curing the silicates.

11. The method of Claim 10, wherein the silicates include metal ions taken from Group 1A elements.

12. The method of Claim 10, wherein the aqueous inorganic silicates include 5 to 50 parts 2:00 weight ratio aqueous sodium silicate solution,

5 to 50 parts 3:22 weight ratio aqueous sodium silicate solution, and

20 to 90 parts 2:50 weight ratio potassium silicate solution.

13. The method of Claim 10, wherein the aqueous inorganic silicates include

36 parts 2:00 weight ratio aqueous sodium silicate solution,

24 parts 3:22 weight ratio aqueous sodium silicate solution, and

40 parts 3:22 weight ratio aqueous sodium silicate solution.

14. The method of Claim 12, wherein the step of applying the solution includes the step of immersing the parts into the solution with or without mechanical or ultrasonic agitation, or vacuum assist, followed by air blast removal of excess solution.

15. The method of Claim 12, wherein the step of applying the solution includes the step of spraying the solution onto the parts, followed by air blast removal of excess solution.

16. The method of Claim 12, wherein the step of applying the solution includes the step of dipping, dip-spinning, or dip/draining the parts in the solution, with or without vacuum assist, followed by air blast renewal of excess solution.

17. The method of Claim 12, wherein the step of curing comprises:

applying heat to the parts such that the surfaces of the parts reach 125-400°F.

18. The method of Claim 12, wherein the alternate step of curing comprises:

applying a mild acidic aqueous solution to the parts by spray immersion, immersion with mechanical or ultrasonic agitation, immersion with vacuum assist, dip-drain or dip-spin followed by a warm water rinse and drying.

19. The method of Claim 18, wherein the mild acidic solution is phosphoric acid diluted in water to a concentration from 5 to 25 percent.

20. The method of Claim 12, wherein the aqueous inorganic silicate further includes a lithium silicate sol having a weight ratio of silicate to alkali expressed as SiO_2:Li_2 of typically 10:0,

and the step of curing includes subjecting the parts to ambient temperature.